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13. ABSTRACT

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The study showed that MOD-FLSIP stocks more CASREP items than FLSIP or MCO. MCO COSAL produced higher range, lower cost, and better overall requisition effectiveness than FLSIP or MOD-FLSIP, but MOD-FLSIP had higher DLR effectiveness. Since satisfying CASREP requisition from on-board stock is considered the most important Fleet support measure, FMSO recommends that MOD-FLSIP be used as the standard COSAL policy for all FFG-7 class ships.

EVALUATION OF THE MCO COSAL POLICY

OPERATIONS ANALYSIS DEPARTMENT

NAVY FLEET MATERIAL SUPPORT OFFICE
Mechanicsburg, Pennsylvania 17055

Report 161

EVALUATION OF THE MCO COSAL POLICY

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REPORT 161

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Abstract

This study evaluates the Maintenance Criticality Oriented (MCO) Coordinated Shipboard Allowance List (COSAL) policy. The objective was to determine the impact on peacetime Fleet support of using MCO COSAL (with current or modified parameters) in lieu of Fleet Logistics Support Improvement Program (FLSIP) COSAL or MOD-FLSIP COSAL. Impact statements were made in terms of potential for reductions in Casualty Reporting (CASREP) requisition and increases in effectiveness.

The study showed that MOD-FLSIP stocked more CASREP items than FLSIP or MCO. MCO COSAL produced higher range, lower cost, and better overall requisition effectiveness than FLSIP or MOD-FLSIP, but MOD-FLSIP had higher Depot Level Repairable (DLR) effectiveness. Since satisfying CASREP requisition from on-board stock is considered the most important Fleet support measure, FMSO recommends that MOD-FLSIP be used as the standard COSAL policy for all FFG-7 class ships.

Executive Summary

1. Background: In August of 1980, Chief of Naval Operations (CNO) approved the MOD-Fleet Logistics Support Improvement Program (FLSIP) Coordinated Shipboard Allowance List (COSAL) implementation. At the same time, CNO approved the Maintenance Criticality Oriented (MCO) COSAL for third flight FFG-7 class ships. To determine the impact on peacetime Fleet support of using MCO COSAL in lieu of FLSIP or MOD-FLSIP COSAL, it was proposed that an analysis be done using the FFG-9, FFG-10, FFG-13 and DDG-46 as test ships and utilizing historical Navy Maintenance and Material Management System (3M) and Casualty Reporting (CASREP) data.

Mission Criticality Codes (MCCs) are used in the MCO and MOD-FLSIP COSAL production. The FFG-9, FFG-10, and FFG-13 test ships had no MCCs, so MCCs first had to be assigned to all their equipments. The DDG-46 already had MCCs loaded in the Weapons System File (WSF) for its equipment. Navy Ships Parts Control Center (SPCC) used MCCs already developed for third flight FFG-7 ships to assign MCCs to the first flight FFG-7 class test ships. Remaining voids were assigned manually by Naval Sea Systems Command (NAVSEASYSCOM).

2. Objective. The objective of this study was to determine the impact on peacetime Fleet support of using MCO COSAL in lieu of FLSIP or MOD-FLSIP COSAL.

3. Methodology. SPCC equipment configuration files and three year history of 3M and CASREP usage data were obtained for the four test ships. Utilizing the 3M and CASREP historical data, statistics were gathered for each of the COSAL models. Impact statements were made in terms of potential for reduction in CASREP requisitions and increases in 3M effectiveness.

4. Finding. It was shown that MCO stocked more items than MOD-FLSIP for less money. Although MCO COSAL achieved higher model requisition effectiveness than MOD-FLSIP (four to seven percentage points overall and seven to 11 percentage points for items coded vital for MCC 4 equipments), it achieved lower requisition effectiveness for Depot Level Repairables (DLRs) than MOD-FLSIP (17 to 22 percentage points). Also, MOD-FLSIP performed better than MCO in terms of satisfying CASREP requisitions for COSAL candidate items (seven to 17 percentage points overall and zero to 32 percentage points for C3s and C4s). The MOD-FLSIP model also stocked more CASREP requisition items than FLSIP.

5. Recommendation. Since satisfying CASREP requisitions from on-board stock is considered the most important measure of Fleet support, FMSO recommends that MOD-FLSIP be used as the standard COSAL model for all FFG-7 class ships.

TABLE OF CONTENTS

I. INTRODUCTION

The task of supporting the number and types of ships in the Fleet, each configured with different equipments and operating from various support bases worldwide, is a complex and difficult one. A vital part of the logistics support system is the process of determining spare parts to be stocked aboard ship. In past years a number of independent efforts aimed at developing alternative models for determining shipboard allowances resulted in recommendations for changes to or deviations from current policy. Fleet readiness statistics provided support for these efforts to improve material availability aboard ship. The complexity of the variables that impact on allowance policy suggested the need for a review of the current and alternative allowance policies and associated stocking models. Center for Naval Analyses (CNA) was tasked to conduct such a review.

As a result of the above, in August of 1980, Chief of Naval Operations (CNO), approved implementation of the Modified Fleet Logistics Support Improvement Program (MOD-FLSIP) Coordinated Shipboard Allowance List (COSAL) model. At the same time, a separate Maintenance Criticality Oriented (MCO) COSAL model was approved for third flight FFG-7 class ships.

Currently, the first and second flight FFG-7 class ships have FLSIP COSALs and third flight FFG-7 class ships have MCO COSALs. To determine the impact on peacetime Fleet support of using MCO COSAL in lieu of FLSIP or MOD-FLSIP COSAL, reference 1 of APPENDIX A requested Navy Fleet Material Support Office (FMSO) conduct a study using FFG-9, FFG-10, FFG-13 and the DDG-46 as test ships, and historical Navy Maintenance and Material Management System (3M)

and Casualty Reporting (CASREP) data. Impact statements were required in terms of range, investment, the potential for reduction in CASREPs and increases in supply effectiveness.

FMSO was also tasked to determine the impact of using proposed revised Mission Criticality Codes (MCCs) in MCO and MOD-FLSIP COSALs production in lieu of the current MCCs and to evaluate MCO with parameters modified to increase support for MCCs 2 and 3 items and reduce support for MCC 4 items. A modified MCO COSAL model similar to the TRIDENT COSAL model was also evaluated. Detailed descriptions of the approach used in conducting the study and the findings of the study are provided in the following sections of this report.

II. TECHNICAL APPROACH

A. TEST SHIPS. Four ships, FFG-9 (USS WADSWORTH), FFG-10 (USS DUNCAN), FFG-13 (USS SAMUEL E. MORISON), and DDG-46 (USS PREBLE), were designated by Naval Supply Systems Command (NAVSUPSYSCOM) as test ships for this study. The FFGs cited above were selected for the following reasons: (1) they were included in the first flight of the FFG-7 class shipbuilding program and are considered to have sufficient 3M and CASREP usage data available for analysis, (2) they were constructed at different shipbuilding yards, so that each FFG-7 class shipyard (Los Angeles, Bath, and Seattle) is represented, and (3) they have Equipment Identification Codes (EICs) loaded in the Weapon System File (WSF). EICs are required for loading MCCs, which are required for determining MCO and MOD-FLSIP COSALs. The method for assigning MCCs is discussed in Section IIB. The DDG-46 was selected for three reasons: (1) it had MCCs loaded in the WSF, (2) it does not go into overhaul for about two years; thus,

the WSF configuration should reflect the configuration that generated the available demand and CASREP data, and (3) it was selected to determine the desirability of transitioning all ships to some form of MCO model.

Allowance candidate files for each of these ships were obtained from the Navy Ships Parts Control Center's (SPCC) WSF. The candidate files represented the ships configuration as of April 1983 for the FFG-9, 10, and 13 and March 1983 for the DDG-46.

An MCO, FLSIP and MOD-FLSIP COSAL were built for each of the four test ships. FLSIP and MOD-FLSIP were evaluated relative to MCO. The evaluation measures are described in Section IIC.

B. MCC ASSIGNMENTS. MCCs range from 1 to 4, where 4 is the most critical. Equipments with an MCC of 3 or 4 are considered primary equipments. The required MCC coding followed the technique approved by NAVSUPSYSCOM in reference 2 of APPENDIX A. The method of assigning MCC codes to the candidate items is described below.

Currently, MCCs and EICs have been assigned for ships in the third flight of the FFG-7 class ships. EICs have been assigned to the three FFG test ships. SPCC mechanically assigned MCCs to the FFG-10 as follows: (1) for all EICs on the FFG-37 which had only one MCC assigned to the Allowance Parts Lists (APLs) within the EIC, assign this MCC to all APLs on that EIC on the FFG-10 and (2) for all EICs on the FFG-37 which have more than one MCC assigned to the APLs within the EIC, assign MCCs based on an EIC/APL match. This process was also used to mechanically assign MCCs for the FFG-13 based on the FFG-36 data and for the FFG-9 based on the FFG-38 data. Assignment of MCCs for the FFG-10 test ship was based on the MCC assigned to the FFG-37, since both ships were built in the same shipyard (Seattle). Similarly, assignment of MCCs for the FFG-13 and FFG-9 were based on MCCs assigned to the FFG-36 and FFG-38,

respectively, since these pairs of ships were built in the same shipyard (Bath and Los Angeles). Naval Sea Systems Command (NAVSEASYSCOM) manually assigned MCCs to the Unit Identification Codes (UICs)/APLs for which MCCs could not be assigned mechanically. The manual and mechanized files were forwarded to FMSO for use in this study. The DDG-46 MCC assignment was based on CASREP data. TABLE I displays the MCC assignments by ship.

TABLE I

MCC ASSIGNMENT RESULTS

TEST SHIP	MCC 1	MCC 2	MCC 3	MCC 4
FFG-9	7,232 (22%)	6,860 (21%)	10,796 (33%)	7,937 (24%)
FFG-10	7,135 (22%)	6,964 (22%)	10,524 (33%)	7,393 (23%)
FFG-13	7,084 (21%)	7,593 (23%)	10,876 (33%)	7,615 (23%)
DDG-46	15,572 (25%)	16,469 (26%)	23,577 (38%)	6,706 (11%)

During the manual assignment of MCCs by NAVSEASYSCOM, it was discovered that there were variations between the MCC assignments by SPCC and the MCCs prescribed by reference 2 of APPENDIX A. A review was made and numerous revisions to the MCC data base were made. These revisions prompted NAVSUPSYSCOM to also task FMSO to evaluate the impact of the revised MCCs on the MCO and MOD-FLSIP COSAL models.

C. PERFORMANCE MEASURES. The effectiveness measurements in this study were based on historical shipboard usage data obtained from the 3M system. Twelve quarters of 3M usage data for the period January 1980 through December 1982 were obtained for each of the four test ships. To measure the impact of each COSAL model on CASREPs, a three year history of CASREP parts requisition data for the period January 1980 through December 1982 was obtained from the

CASREP Master Data Bank for each test ship. An analytic program was developed to measure the performance of each model in terms of (1) range, (2) dollar value, (3) range effectiveness, (4) requisition effectiveness, and (5) CASREP support. These statistics are defined below:

Range - this statistic is computed by adding the number of items stocked.

Dollar Value - this figure is the total cost of the allowances determined for the selected items.

Model Range Effectiveness - the number of items demanded and selected for stockage divided by the total number of candidate items demanded (based on 3M demands).

Model Requisition Effectiveness - this figure is the number of 3M requisitions satisfied divided by the number of 3M requisitions placed for candidate items (considers only demands for items considered by the model).

Gross Requisition Effectiveness - this statistic is computed by dividing the number of 3M requisitions satisfied by the total number of 3M requisitions placed (considers demands for all items).

CASREP Support - measures the number of CASREPs for which the item would have been stocked by the model.

Requisitions that were partially satisfied were considered as fully satisfied for this study. Both gross and model effectiveness measures were computed quarterly reflecting the fact that a COSAL is built under a 90 day sustainability scenario. In measuring requisition effectiveness, a full allowance quantity was assumed to be available at the beginning of each quarter for comparison with the usage data for the quarter. An overall value was then computed for each effectiveness measure. This value measures the support for each model over the entire 12 quarter period considered in this evaluation. This overall value is the effectiveness statistic shown in the report.

Counts of the number of CASREP requisitions for which the requested item was stocked and the number of requisitions for which the requested item was not stocked were obtained, by severity, for each model. These counts were tallied for each of the four test ships. For the purpose of impact statements, only allowance candidate items were considered in this process. However, counts of the number of requisitions for which the requested item was not an allowance candidate were obtained. 3M and CASREP data for these noncandidate items for the four test ships were provided to NAVSEASYSCOM for analysis. Finally, separate measurements were made by MCC and for consumable and repairable categories of material.

D. COSAL MODELS. Descriptions of the COSAL models used in this study are included in APPENDIX B.

III. FINDINGS

A. RANGE/DOLLAR VALUE/EFFECTIVENESS IMPACT. The impact on range, dollar value, and overall range and requisition (Model and Gross) effectiveness is shown in TABLE II. Range and dollar value figures are for Store Room Items (SRIs) only. The Operating Space Item (OSI) figures are not shown because allowances for these items are predetermined quantities and not computed by any model. Since this is an evaluation of the MCO COSAL model, it is used as the benchmark for this study. Comparing MCO to MOD FLSIP and FLSIP across the four ships, TABLE II shows that MCO has a higher range of items, greater model and gross effectiveness, and costs less than MOD-FLSIP. Comparing MCO to FLSIP, the same results as above occur except that FLSIP costs more for the DDG-46 and less for the FFG test ships.

TABLE II

EFFECTIVENESS IMPACT
(CURRENT MCCs)

SHIP	MODEL	SRI RANGE	SRI $ VALUE	MODEL RANGE EFFECTIVENESS	MODEL REQN EFFECTIVENESS	GROSS REQN EFFECTIVENESS
FFG-9	MCO	13,751	3,962K	83%	82%	48%
	MOD-FLSIP	10,387	5,238K	80%	78%	45%
	FLSIP	8,179	3,475K	76%	75%	43%
FFG-10	MCO	13,420	3,792K	77%	79%	53%
	MOD-FLSIP	10,061	5,187K	76%	75%	51%
	FLSIP	7,956	3,490K	71%	71%	48%
FFG-13	MCO	13,958	4,039K	78%	78%	51%
	MOD-FLSIP	10,556	5,315K	72%	71%	45%
	FLSIP	8,368	3,531K	66%	66%	43%
DDG-46	MCO	23,955	3,691K	82%	81%	65%
	MOD-FLSIP	17,324	5,140K	78%	75%	60%
	FLSIP	14,638	4,131K	74%	72%	57%

The impact on model effectiveness by MCC for requisitions is displayed in TABLE III. MCCs reflect the impact of equipment failure on the ship's capability to perform its mission and they range from 1 (least important) to 4 (most important). Comparing MCO to MOD-FLSIP and FLSIP across all ships, the following is observed: MCO model requisition effectiveness is greater than or equal to that for MOD-FLSIP and FLSIP across all MCCs. For example, on the FFG-9, out of all the candidate item requisitions placed for MCC 4 items, 92% of them were satisfied using the MCO model, while MOD-FLSIP and FLSIP satisfied only 85% and 79% of them, respectively. In terms of Navy Stock Account (NSA) and Depot Level Repairable (DLR) breakdown, the following is observed. MCO satisfied a higher percentage of requisitions for NSA items

than MOD-FLSIP and FLSIP across all ships; but both MOD-FLSIP and FLSIP satisfied a higher percentage of requisitions for DLR items than MCO across all ships.

TABLE III

MODEL REQUISITION EFFECTIVENESS
(CURRENT MCCs)

SHIP	MODEL	MCC 1	MCC 2	MCC 3	MCC 4	NSA	DLR
FFG-9	MCO	65%	75%	78%	92%	85%	51%
	MOD-FLSIP	65%	68%	76%	85%	79%	69%
	FLSIP	65%	70%	67%	79%	76%	59%
FFG-10	MCO	60%	74%	77%	92%	85%	49%
	MOD-FLSIP	58%	71%	77%	83%	76%	66%
	FLSIP	58%	72%	69%	76%	73%	59%
FFG-13	MCO	63%	71%	77%	92%	80%	51%
	MOD-FLSIP	56%	61%	74%	82%	71%	68%
	FLSIP	57%	62%	62%	75%	67%	57%
DDG-46	MCO	57%	74%	84%	93%	83%	50%
	MOD-FLSIP	55%	65%	80%	82%	75%	72%
	FLSIP	57%	65%	72%	78%	72%	68%

B. CASREP IMPACT. The impact on CASREPs is shown in TABLEs IV and V. CASREP impact is measured by severity for each test ship, ranging from C2 (Substantially Ready) to C4 (Not Ready). For this study, we did not consider COSAL depth. Only range of items was considered. In other words, all CASREPs for items that were stocked by the applicable COSAL model were considered satisfied, regardless of depth. Considering COSAL depth would require a simulation of resupply rules.

TABLE IV displays CASREP requisitions for candidate and noncandidate items for each ship by severity. Overall, most CASREP requisitions for candidate and noncandidate items were C2 severity. The major difference between candidate and noncandidate categories is that noncandidate items are not considered for stockage by the model, whereas candidate items are considered for stockage by the model. If all candidate items were stocked, the maximum percentage of CASREP requisitions satisfied ranges from a low of 47% for the FFG-13 to a high of 74% for the DDG-46.

TABLE IV

CASREP IMPACT

SHIP	CASREP REQNS FOR CANDIDATE ITEMS				CASREP REQNS FOR NONCANDIDATE ITEMS				MAX ACHIEVABLE CASREP SATISFACTION RATE
	C2	C3	C4	TOTAL	C2	C3	C4	TOTAL	
FFG-9	98	33	37	168	43	24	14	81	67
FFG-10	225	58	7	290	116	22	4	142	67
FFG-13	236	56	6	298	257	80	2	339	47
DDG-46	381	25	0	406	135	7	0	142	74

TABLE V displays CASREP requisition results for each model within each test ship by severity. Focusing on the total column, we observed the following: MOD-FLSIP range would satisfy more CASREP requisitions than MCO or FLSIP. These results are similar across all ships. For example, for the FFG-9 total count, we find that MOD-FLSIP range would have satisfied 107 CASREP requisitions which is 64% of the total CASREP requisitions for candidate items [168 per TABLE IV] and that FLSIP range would have

satisfied 96 CASREP requisition items, which is 57% of the total CASREP requisitions for candidate items. Similarly, MCO range would have satisfied only 53% of the total CASREP requisitions for candidate items.

TABLE V

CASREP REQUISITIONS FOR STOCKED ITEMS
(% OF TOTAL CASREPS FOR CANDIDATE ITEMS)
(CURRENT MCCs)

SHIP	MODEL	SEVERITY CODE							
		C2		C3		C4		TOTAL	
		#	%	#	%	#	%	#	%
FFG-9	MCO	46	47	18	55	25	68	89	53
	MOD-FLSIP	63	64	18	55	26	70	107	64
	FLSIP	55	56	17	52	24	65	96	57
FFG-10	MCO	88	39	28	48	4	57	120	41
	MOD-FLSIP	120	53	42	74	5	71	168	58
	FLSIP	94	41	29	50	3	43	126	44
FFG-13	MCO	123	52	39	70	2	33	164	55
	MOD-FLSIP	142	60	41	73	2	33	185	62
	FLSIP	121	51	37	66	2	33	160	54
DDG-46	MCO	236	62	8	32	0	0	244	60
	MOD-FLSIP	259	68	16	64	0	0	275	68
	FLSIP	229	60	9	36	0	0	238	59

TABLE VI displays CASREP requisition results for NSA and DLR. The table shows that MOD-FLSIP stocked more DLR CASREP items than MCO, and except for one case (DDG-46), MOD-FLSIP also stocked more NSA CASREP items than MCO. The MCO model stocks more NSA CASREP items than FLSIP but less DLR items.

TABLE VI

CASREP REQUISITIONS FOR STOCKED ITEMS
BY COG CATEGORY
(CURRENT MCCs)

SHIP	MODEL	NSA	DLR	TOTAL
FFG-9	MCO	60	29	89
	MOD-FLSIP	65	42	107
	FLSIP	59	37	96
FFG-10	MCO	58	62	120
	MOD-FLSIP	63	105	168
	FLSIP	50	76	126
FFG-13	MCO	112	52	164
	MOD-FLSIP	113	72	185
	FLSIP	103	57	160
DDG-46	MCO	201	43	244
	MOD-FLSIP	199	76	275
	FLSIP	183	55	238

FMSO also evaluated the impact of using the revised MCCs and the impact of using modified parameters in the MCO COSAL. Detailed results for these two analyses are shown in APPENDICES C and D, respectively. These results are in agreement with the trends shown in the main body of the report, and are summarized below:

- Revised MCCs: Revised MCCs slightly increased the range and increased requisition effectiveness 0-2 percentage points for MCO and MOD-FLSIP over current MCCs. The percent of CASREP items stocked increased by 0-3 percentage points, while investment decreased.

- Modified Parameters: The MOD-MCO (TRI), MOD-MCO (2) and MOD-MCO (1) were developed using modified parameters (affecting minimum protection levels) in the MCO COSAL model. The MOD-MCO (TRI) model was developed with the TRIDENT Protection goal in mind. It improved effectiveness with a slight decrease in

range and increase in dollar value as compared to MCO. It had better effectiveness with less cost than MOD-FLSIP and it fell within 4% of the MOD-FLSIP CASREP impact. The MOD-MCO (2) model was proposed by NAVSUPSYSCOM to increase support for MCC 2 and 3 items and decrease support for MCC 4 items. Compared to MCO, the MOD-MCO (2) model increased range and dollar value, increased effectiveness for MCC 2 and 3 items, decreased support for MCC 4 items and increased overall CASREP results. However, the CASREP support rate was still 8% less than MOD-FLSIP. MOD-MCO (1) was proposed by NAVSUPSYSCOM to improve support for MCC 3 items. Results were almost identical to the MCO results.

IV. CONCLUSIONS

This study evaluated the impact on peacetime Fleet support, based on historical data, of using MCO COSAL in lieu of FLSIP and MOD-FLSIP COSAL. It was shown that MCO produced a higher range of items, higher model effectiveness, and less investment than MOD-FLSIP; but the MOD-FLSIP range satisfies more CASREP requisitions. It was also shown that MCO produced a higher range of items, higher model requisition effectiveness, and in three of four cases, lower costs than FLSIP. There was no consistent pattern in MCO and FLSIP CASREP results. A summary of findings is shown in TABLE VII.

TABLE VII

SUMMARY OF FINDINGS

(CURRENT MCCs)

	DIFFERENCE IN MCO RELATIVE TO FLSIP	DIFFERENCE IN MCO RELATIVE TO MOD-FLSIP
RANGE (SRI)	+64 TO +69%	+32 TO +38%
$ VALUE (SRI)	-11 TO +14%	-24 TO -28%
MODEL REQUISITION EFFECTIVENESS		
ALL ITEMS	+ 7 TO +12%	+ 4 TO + 7%
MCC 4	+13 TO +17%	+ 7 TO +11%
MCC 3	+ 8 TO +15%	0 TO + 4%
MCC 2	+ 2 TO + 9%	+ 3 TO +10%
MCC 1	0 TO + 6%	0 TO + 7%
CASREP REQUISITIONS (CANDIDATE ITEMS)		
TOTAL	- 4 TO + 1%	-17 TO - 7%
C4	0 TO +14%	-14 TO 0%
C3	- 4 TO + 4%	-32 TO 0%
C2	- 9 TO + 2%	-14 TO - 6%

The bottom line is that the MCO model produced better requisition effectiveness at less cost than FLSIP or MOD-FLSIP; but MOD-FLSIP stocked more CASREP items than MCO or FLSIP. There is no set guidelines as to which is most important. From references 3 and 4 of APPENDIX A, the concensus was that satisfying CASREP requisitions from on-board stock is more important to the Fleet. Results show that MOD-FLSIP stocks more CASREP requisition items.

V. RECOMMENDATION

FMSO recommends that MOD-FLSIP be used as the standard COSAL model for all FFG-7 class ships.

APPENDIX A: REFERENCES

1. COMNAVSUPSYSCOM ltr 04A6/LJB of 10 March 1983.

2. OPNAVINST 4000.83 of 21 August 1981, "Supply and Maintenance Support of the FFG-7 Class Weapon System".

3. Mtg between representatives of NAVSUPSYSCOM/NAVSEALOGSUPENGACT/FMSO on 19 April 1984.

4. Mtg between representatives of NAVSUPSYSCOM/NAVSEALOGSUPENGACT/FMSO on 18 September 1984.

APPENDIX B: COSAL MODELS

The following is a brief algorithm of the Coordinated Shipboard Allowance List (COSAL) models used in this study.

A. FLEET LOGISTICS SUPPORT IMPROVEMENT PROGRAM (FLSIP) MODEL

- COMPUTE EXPECTED DEMAND (EXP DMD)
- DEMAND BASED CHECK
  - IS EXP $DMD_{90DAYS} \geq 1.00$?
    - IF YES, COMPUTE AQ TO GIVE 90% PROTECTION AGAINST STOCKOUT
    - IF NO, MAKE INSURANCE ITEM CHECK
      - INSURANCE ITEM CHECK
        (1) IS COMPONENT TO MISSION MEC (MILITARY ESSENTIALITY CODE) VITAL?
        (2) IS PART TO COMPONENT MEC VITAL?
        (3) IS EXP DMD ANNUAL $\geq$ .25 (1 DEMAND IN FOUR YEARS)?
          - IF YES TO (1), (2) AND (3), STOCK ITEM IN DEPTH OF 1 MRU (MINIMUM REPLACEMENT UNIT)
          - IF NO TO (1), (2) OR (3), DO NOT STOCK UNLESS THERE IS AN OVERRIDE

B. MOD-FLSIP MODEL

. DEMAND-BASED CHECK SAME AS FLSIP

. INSURANCE ITEM CHECK AS FOLLOWS:

FOR PRIMARY COMPONENT (MCC 3 OR 4)

(1) IS PART TO COMPONENT MEC VITAL?

(2) IS EXP DMD ANNUAL $\geq$ .10 (1 DMD IN 10 YEARS)?

. IF YES TO (1) AND (2), STOCK AT DEPTH OF 1 MRU IF EXP DMD ANNUAL $<$ 2.00 OR AT DEPTH OF TWO MRUs if 2 $\leq$ EXP DMD ANNUAL $<$ 4.00

. IF NO TO (1) OR (2), DO NOT STOCK UNLESS THERE IS AN OVERRIDE

FOR SECONDARY COMPONENT (MCC 1 OR 2)

(1) IS PART TO COMPONENT MEC VITAL?

. IF YES, SAME AS FLSIP INSURANCE STOCKAGE CRITERIA (3)

. IF NO, DO NOT STOCK UNLESS THERE IS AN OVERRIDE

MCC = MISSION CRITICALITY CODES

C. MAINTENANCE CRITICALITY ORIENTED (MCO) MODEL

COMPUTE AQ = EXP DMD_{90DAYS} + "Z" $X\sqrt{EXP\ DMD}$

WHERE $Z = K_1 - K_2\ (4-MCC) - K_3\ LOG_{10}\ PRICE$

$K_1 = 7 \quad K_2 = 1 \quad K_3 = 1.5$

MCO computes requirements depending on an item's cost and MCC. MCC is the measure of item importance and ranges from 1 (least important) to 4 (most important). Constraints were placed on Z for each MCC. These constraints place minimum levels of protection on each item.

Alternative MCO models were also tested in an attempt to improve Casualty Reporting (CASREP) results. These alternative models were built by varying the Z constraint values. The applicable Z constraints are shown below:

	MCO		MOD-MCO(2)	
MCC	MIN Z Constraints	MOD-MCO(1)	FFGs	DDG-46
1	0	0	0	0
2	.25	.25	1.07	1.5
3	1.7	1.75	2.36	2.00
4	5	5	3.75	3.75

All maximum constraints were equal to 9.99.

Another attempt to improve CASREP results was made by modifying the MCO model to approximate the TRIDENT COSAL model. The parameters used for this model are shown below:

			MOD-MCO (TRI)	
MCC	MIN Z	MAX Z	NSA	DLR
1	0	3	$K_1 = 6.046$	$K_1 = 7.402$
2	0	1.3	$K_2 = 1$	$K_2 = 1$
3	1.3	2.3	$K_3 = 1$	$K_3 = 1$
4	1.3	3.8		
			Avg Unit Price $76	Avg Unit Price $4001

APPENDIX C: RANGE/DOLLAR VALUE/EFFECTIVENESS/CASREP IMPACT FOR REVISED MCCS

TABLE I displays the results of current and proposed revised Mission Criticality Code (MCC) assignments. The proposed revision has fewer MCCs 1, 2 and 4 and more MCC 3s. Revised MCCs were only applicable to FFG test ships.

TABLE I

MCC ASSIGNMENT RESULTS

TEST SHIP	MCC 1	MCC 2	MCC 3	MCC 4
FFG-9	7,232 (22%)	6,860 (21%)	10,796 (33%)	7,937 (24%)
FFG-10	7,135 (22%)	6,964 (22%)	10,524 (33%)	7,393 (23%)
FFG-13	7,084 (21%)	7,593 (23%)	10,876 (33%)	7,615 (23%)
DDG-46	15,572 (25%)	16,469 (26%)	23,577 (38%)	6,706 (11%)

REVISED MCC ASSIGNMENT RESULTS

TEST SHIP	MCC 1	MCC 2	MCC 3	MCC 4
FFG-9	6,246 (19%)	5,429 (17%)	16,351 (50%)	4,799 (15%)
FFG-10	6,240 (20%)	5,094 (16%)	16,167 (51%)	4,515 (14%)
FFG-13	6,189 (19%)	5,709 (17%)	16,449 (50%)	4,821 (15%)

The impact of revised MCCs on range, dollar value, overall range and requisition effectiveness, model requisition effectiveness (by MCC, Depot Level Repairable (DLR), and Navy Stock Account (NSA)) and Casualty Reporting (CASREPs) are shown in TABLEs II through V. The following statements can be made about revised MCC results: Revised MCCs slightly increase the range and requisition effectiveness improved 0-2 percentage points for MCO and Modified Fleet Logistics Support Improvement Program (MOD-FLSIP) over current MCCs. The percent of CASREP items stocked increased by 0-3 percentage points, while investment decreased.

TABLE II

EFFECTIVENESS IMPACT
(REVISED MCCS)

SHIP	MODEL	SRI RANGE	SRI $ VALUE	MODEL RANGE EFFECTIVENESS	MODEL REQN EFFECTIVENESS	GROSS REQN EFFECTIVENESS
FFG-9	MCO	13,790	3,813K	84%	83%	48%
	MOD-FLSIP	10,613	5,130K	81%	79%	45%
	FLSIP	8,179	3,475K	76%	75%	43%
FFG-10	MCO	13,477	3,739K	78%	80%	54%
	MOD-FLSIP	10,395	5,102K	78%	76%	52%
	FLSIP	7,956	3,490K	71%	71%	48%
FFG-13	MCO	14,011	3,902K	80%	80%	52%
	MOD-FLSIP	10,810	5,181K	74%	72%	48%
	FLSIP	8,368	3,531K	66%	66%	43%

TABLE III

MODEL REQUISITION EFFECTIVENESS
(REVISED MCCs)

SHIP	MODEL	MCC 1	MCC 2	MCC 3	MCC 4	NSA	DLR
FFG-9	MCO	69%	71%	83%	90%	85%	52%
	MOD-FLSIP	69%	62%	80%	83%	79%	70%
	FLSIP	65%	70%	67%	79%	76%	59%
FFG-10	MCO	69%	66%	80%	94%	84%	48%
	MOD-FLSIP	64%	66%	79%	84%	77%	69%
	FLSIP	58%	72%	69%	76%	73%	59%
FFG-13	MCO	69%	68%	81%	88%	83%	53%
	MOD-FLSIP	62%	58%	74%	79%	73%	69%
	FLSIP	57%	62%	62%	75%	67%	57%

TABLE IV

CASREP REQUISITIONS FOR STOCKED ITEMS
(% OF TOTAL CASREPS FOR CANDIDATE ITEMS)
(REVISED MCCs)

SHIP	MODEL	SEVERITY CODES							
		C2		C3		C4		TOTAL	
		#	%	#	%	#	%	#	%
FFG-9	MCO	49	50	18	55	26	70	93	55
	MOD-FLSIP	62	63	18	55	27	73	107	64
	FLSIP	55	56	17	52	24	65	96	57
FFG-10	MCO	90	40	27	47	4	57	121	42
	MOD-FLSIP	129	57	43	74	5	71	177	61
	FLSIP	94	41	29	50	3	43	126	44
FFG-13	MCO	129	55	39	70	2	33	170	57
	MOD-FLSIP	142	60	41	73	2	33	185	62
	FLSIP	121	51	37	66	2	33	160	54

TABLE V

CASREP REQUISITION FOR STOCKED ITEMS
BY COG CATEGORY
(REVISED MCCS)

SHIP	MODEL	NSA	DLR	TOTAL
FFG-9	MCO	60	33	93
	MOD-FLSIP	65	42	107
	FLSIP	59	37	96
FFG-10	MCO	63	58	121
	MOD-FLSIP	64	113	177
	FLSIP	50	76	126
FFG-13	MCO	118	52	170
	MOD-FLSIP	113	72	185
	FLSIP	103	57	160

APPENDIX D: MOD-MCO RESULTS

The impact of using MCO with modified parameters (Modified Maintenance Criticality Oriented (MOD-MCO)) are shown in TABLE I. MOD-MCO (TRI) was developed by using separate Average Unit Prices for NSA and DLR and incorporating the TRIDENT Coordinated Shipboard Allowance List (COSAL) protection goals. This model was competitive with Modified Fleet Logistics Support Improvement Program (MOD-FLSIP) Casualty Reporting (CASREP) results. It has better requisition effectiveness with less cost than MOD-FLSIP and it fell within 4% on CASREP impact. It also improved requisition effectiveness, with a slight decrease in range and increase in dollar value, as compared to MCO.

MOD-MCO (2) was proposed by Naval Supply Systems Command (NAVSUPSYSCOM) to increase support for Mission Criticality Code (MCC) 2 and 3 items and decrease support for MCC 4 items. Compared to MCO, the MOD-MCO (2) model increased range and dollar value, increased effectiveness for MCC 2 and 3 items, decreased support for MCC 4 items, and increased overall CASREP results. However, CASREP support rate was 8% lower than MOD-FLSIP.

MOD-MCO (1) was proposed by NAVSUPSYSCOM to improve support for MCC 3 items. Results were almost identical to the MCO results. The actual parameters used in the three MOD-MCO models are shown in APPENDIX B.

TABLE I

EFFECTIVENESS IMPACT

SHIP	MODEL	SRI RANGE	SRI $ VALUE	MODEL EFF. RANGE	MODEL EFF. REQN	MODEL REQN EFF BY MCCS % 1	2	3	4	GROSS REQN EFF	CASREP REQN FOR STOCKED ITEMS (CANDIDATE ITEMS ONLY) C2 #	C2 %	C3 #	C3 %	C4 #	C4 %	TOTAL #	TOTAL %
FFG 9	MOD-MCO (TRI)	13,276	4,829K	84%	83%	67%	77%	79%	90%	48%	55	56	19	58	26	70	100	60
	MOD-MCO (2)	13,895	4,964K	84%	83%	65%	77%	80%	91%	48%	50	51	19	58	25	68	94	56
	MOD-MCO (1)	13,842	4,370K	83%	82%	65%	75%	79%	92%	48%	46	47	18	55	25	68	89	53
	MCO	13,751	3,962K	83%	82%	65%	75%	78%	92%	48%	46	47	18	55	25	68	89	53
	MOD-FLSIP	10,387	5,238K	80%	78%	65%	68%	76%	85%	45%	63	64	18	55	26	70	107	64
	FLSIP	8,179	3,475K	76%	75%	65%	70%	67%	79%	43%	55	56	17	52	24	65	96	57

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